

EXECUTIVE SUMMARY

This report presents the results of a treatability study to evaluate the effectiveness of surfactants in enhancing the removal of dense non-aqueous phase liquid (DNAPL) from soils at Operable Unit 2 (OU 2) at Hill Air Force Base. The study consisted of a screening study to identify surfactants capable of solubilizing DNAPL, followed by batch studies with contaminated soils collected from OU 2 to rank the performance of the surfactants.

Four nonionic surfactants, two anionic surfactants, and ethanol were selected for the screening study. Three surfactants proved capable of enhancing the solubilization of DNAPL (FC-760, Witconol H-31A, and Monawet MM-80). Monawet MM-80 and Witconol H-31A were the most promising surfactants and were used in the subsequent batch studies (*Technical Addendum to the Surfactant Screening, Analytical Development Memorandum for Operable Unit 2*, Radian, 1993).

A 10% Monawet MM-80/1% NaCl (W/W) solution prepared in groundwater collected from the base was the most effective surfactant solution in the screening and batch studies. The average trichloroethene (TCE) concentration in the surfactant solution phase from the screening studies was 204,000 mg/L. This system removed nearly 100% of the TCE from the soils.

If an aggressive cleanup strategy is pursued to remediate contamination in the saturated zone of the source area at OU 2, surfactants appear to be a promising treatment technology. No unwanted precipitants were observed, and the emulsion layer readily collapsed and did not appear to be too viscous. Volatilities of contaminants are expected to decrease with the use of surfactants, but preliminary discussions with the surfactant manufacturer suggest that either acidification, or the heat in the steam stripping system at the Source Recovery System (SRS), should be sufficient to collapse the micelles (without thermally degrading the surfactant).

Approximate costing has been provided on the basis of batch study data. When used in conjunction with a conventional pump and treat system (i.e., the SRS), the incremental increase in development, design, and construction costs to inject surfactants in the saturated zone at OU 2 is approximately 50% of the cost of the pump and treat system. However, there are considerable potential benefits associated with the incremental cost increase. Estimates using batch study data suggest that after approximately 24 years of operation, the residual soil concentrations using a conventional pump and treat system would still be one thousand times greater than the residual levels which could be achieved with a surfactant system in only two years. These estimates ignore the possibility of the continuing release of DNAPL trapped in the Alpine Formation clay underlying the sands and gravels.

One of the remediation goals for OU 2 is the restoration of contaminated media for future use (*Feasibility Study Report for Operable Unit 2, Radian, 1993*). Surfactants are a promising alternative for restoring contaminated soils, thereby enabling the long-term attainment of groundwater remediation objectives. If an aggressive cleanup strategy is pursued for the saturated zone in the source area, further development of surfactant treatment is highly recommended. Further surfactant technology development and pilot-test strategies have been provided.